

funds are forthcoming due growth and development in the scientific departments are impossible. There certainly appears to be an absence of extravagance. The average annual income of the forty-four professors is not more than £550*l.*, and the average income of university teachers, other than professors, is only £250*l.* a year. The needs of the University, as detailed in the article, are indeed numerous, and the means of satisfying them are at present ludicrously inadequate. As has been done with wearisome iteration in these columns, the article refers to American and German munificence on behalf of higher education, and points out the tempting chance of sensible generosity the needs of Cambridge offer to our men of wealth. The generous provision made for university education in Germany and the United States, the part played by such education in the progress of a modern State, and the need that exists to strengthen our intellectual defences if we are to take a leading position in the struggle toward efficiency, were described by Sir Norman Lockyer in his presidential address to the British Association at Southport in 1903. The warning uttered on that occasion, and the position taken as to the significance of higher education to national progress, have been the means of directing attention to our educational deficiencies, and a beginning has been made to remedy them by increased grants to university colleges. A capital sum of a million and a half sterling would solve all difficulties at Cambridge, but wealthy benefactors tarry, probably because the State has not in the past shown its belief in the value of university education; meanwhile the work of a great university languishes.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, February 15.—“Reciprocal Innervation of Antagonistic Muscles. Ninth Note. Successive Induction.” By Prof. C. S. Sherrington, F.R.S.

In various reflex reactions inhibition is succeeded by marked exaltation of activity in the arcs inhibited. This after-effect may be figured as a rebound from inhibition.

An example is the following. When a dog in which the spinal cord has been transected in the thoracic region is, the period of shock having passed, supported so that its spine is vertical and its hind limbs hang freely, these latter begin to perform a rhythmic stepping movement.

Suppose this reflex is in regular progress and is being recorded from one knee, e.g. right, by a thread passing thence to a pulley and light lever, if then the other thigh (left) be gently supported from behind the knee the record shows that the stepping reflex at once ceases in the right limb. The reflex, on recommencing after this pause, continues as it ceases, that is, its tempo and amplitude are practically the same as before the interruption.

This result contrasts with the following. The reflex can be cut short by a strong squeeze of the tail.

The application of this stimulus to the tail does not in any way interfere mechanically with the stepping movement. Suppose the reflex to be in regular progress and recorded as before, if then the tail stimulus be applied the stepping reflex is almost immediately arrested, and in both limbs. The reflex remains in abeyance while the tail stimulus is continued. On the cessation of the latter the reflex returns, and on its return soon shows indubitable increase in activity as compared with its activity before the inhibitory arrest. The increase is chiefly seen in the amplitude of the movement, but there is also often marked quickening of the tempo of the rhythm. The author has seen the rhythm on some occasions quickened by 30 per cent. The after-increase of the reflex may persist in evidence for many seconds. Its decline is gradual.

The arrest of the stepping reflex by tail inhibition cannot be prolonged indefinitely. The reflex tends to return in spite of the inhibitory stimulation when the latter is long persisted in. It is different when the stepping reflex is arrested by lifting one knee; the reflex does not then tend to break through the arrest, however long the latter be continued. In this form the arrest seems referable simply to cessation of the stimulus which excites the reflex. In tail inhibition the arrest seems referable to a central inhibition, the peripheral stimulus excitatory of the reflex remaining in action all the time.

The after-increase consequent upon inhibition may be conveniently termed “*successive spinal induction*,” the more so as that term directs attention to the likeness between the spinal process and certain visual phenomena commonly designated “induction.”

Again, it is easy to evoke reflex extension of the hind limb by stimulation of the skin of the opposite hind limb. With the spinal dog laid on its side (e.g. left) and a thread attaching the knee of the slightly flexed right limb to a recording lever, the delivery of a stimulus at a skin-point of the left foot evokes reflex extension at right hip and knee. If this stimulus, at moderate and unchanged intensity, be given at regular intervals, a series of extension reflexes of regular height and duration is obtained. If in the course of such a series the right limb is, during one of the intervals, thrown into strong reflex flexion, the next extension-reflex following on the intercurrent flexion differs from those prior to it in being more ample and more prolonged. Its after-discharge is greatly increased and its latency is sometimes diminished. If the test stimulus for the extension-reflex be adjusted at just subliminal value, the intercurrent flexion-reflex will make it supraliminal. The exaltation of the extension-reflex may remain perceptible for five minutes.

Successive spinal induction seems to be a process qualified to play a part in linking together simpler reflexes so as to form from them reflex cycles of action. It appears especially fitted to combine the successive opposite phases of such cyclic reflexes as have been termed “alternating,” and shown to be particularly characteristic of the locomotor activity of the mammalian spinal cord. If a reflex, A, not only temporarily inhibits the action of an antagonistic reflex, B, but also as an immediately subsequent result induces in arc of B a phase of superactivity, the central organ is in that way predisposed for a second reflex opposite to A to occur in immediate succession to A itself. Such an effect seems proved by the observations in this and a preceding communication.

“On the Existence of Cell Communications between Blastomeres.” By C. Shearer. Communicated by Adam Sedgwick, F.R.S.

In cutting sections of a number of segmentation stages of Eupomatus and Polygordius eggs, delicate protoplasmic strands were frequently observed connecting the blastomeres. Experiments with different fixing reagents demonstrated that they were not of the nature of coagulation artifacts, or the result of disintegration of the protoplasm, for in many of the sections in which they were to be seen all the finer details of histological structure were well preserved. Under favourable conditions they could be observed during the living state, and were similar in all respects to the filose strands described by Andrews in a number of Metazoan eggs. They possibly afford a means of coordinating the various cell activities.

PARIS.

Academy of Sciences, April 23.—M. H. Poincaré in the chair.—The president announced the accidental death of M. Curie, and gave a short account of his work.—The eruption of Vesuvius, and in particular, remarks on the explosive phenomena: A. Lacroix. A general account of the recent eruption, with particulars of the lava outflows and the nature of the explosions.—A method allowing of the study of the solar corona at other times than during eclipses: G. Millochau and M. Stefanik. It is proposed to photograph the regions near the sun's edge by means of the spectroheliograph, isolating the line $\lambda 4303$ in the second slit, and eliminating the light from other radiations by means of an appropriate green screen. Preliminary attempts have been made at Meudon with encouraging results, and the authors hope to be able to complete the work at the summit of Mt. Blanc.—Algebraic curves of constant torsion: Eugène Fabry.—Reducible groups of linear and homogeneous transformations: Henry Taber.—The equation of Laplace with two variables: Georges Lery.—The use of an electrical tuning-fork as a generator of alternating currents: M. Devaux-Charbonnel. Some anomalous results obtained with the currents generated in the electromagnet of an electrical tuning-fork were examined with a Duddell oscillograph. The effects produced

appear to be due to the electrostatic capacity, and cause difficulty when tuning-forks are used in multiplex telegraphy.—Diffusion of solutions and molecular weights : Michel **Yégoùnow**.—The atomic weight and spark spectrum of terbium : G. **Urbain**. The atomic weight was determined by estimating the amount of water in the carefully purified sulphate $Tb_2(SO_4)_3 \cdot 8H_2O$, and was found to be 159.2. The spark spectrum of terbium is rich in lines, the wave-lengths of some thirty-seven of the most characteristic being given.—The estimation of cadmium in a volatile or organic salt : H. **Baubigny**. Cadmium sulphide precipitated in the presence of hydrochloric or hydrobromic acids obstinately retains some of the haloid salt, and this, on ignition, owing to the volatility of the chloride and bromide, gives rise to serious losses. The author proposes to convert the impure sulphide into sulphate, and weigh in this form with certain necessary precautions.—Distemper in dogs : H. **Carré**. Dogs which had been kept isolated from birth remained free from distemper, but were always sensitive to inoculation with the disease, whatever mode of inoculation was used. The blood of the animal, collected when the fever is at its height, is sterile, but communicates the disease.—The Tertiary strata at Turritelles and Congeries, Panama : E. **Joukowsky**.—The phenomena of slipping in Sicily : Maurice **Lugeon** and Émile **Argand**.

DIARY OF SOCIETIES.

THURSDAY, MAY 10.

ROYAL SOCIETY, at 4.30.—On Adsorption and Occlusion: the Law of Distribution in the Case in which one of the Phases possesses Rigidity : Prof. M. W. Travers, F.R.S.—Cyanogenesis in Plants, part iv., The Occurrence of Phaselutin in Common Flax (*Linum usitatissimum*), part v., The Occurrence of Phaselutin in Cassava (*Manihot Aipi* and *Manihot Utilissima*) : Prof. W. R. Dunstan, F.R.S., Dr. T. A. Henry, and Dr. S. J. M. Auld.—A Variety of Thorianite from Galle, Ceylon : Prof. W. R. Dunstan, F.R.S., and B. Mouat Jones.—The Mechanism of Carbon Assimilation in Green Plants; the Photolytic Decomposition of Carbon Dioxide *in vitro* : F. L. Usher and J. H. Priestley.—The Action of Anesthetics on Living Tissues, part ii., The Frog's Skin : Dr. N. H. Alcock.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Long Flame Arc Lamps : L. Andrews (Adjourned Discussion).

MATHEMATICAL SOCIETY, at 5.30.—On the Substitutional Theory of Classes and Relations : Hon. B. Russell.—On Linear Differential Equations of Rank Unity : E. Cunningham.—On the Motion of a Swarm of Particles whose Centre of Gravity describes an Elliptic Orbit of Small Eccentricity about the Sun : Dr. E. J. Routh.—The Theory of Integral Equations : H. Bateman.—Singularities of Power Series in Two Variables : G. H. Hardy.

FRIDAY, MAY 11.

ROYAL INSTITUTION, at 9.—Some Astronomical Consequences of the Pressure of Light : Prof. J. H. Poynting, F.R.S.

PHYSICAL SOCIETY, at 8.—The Dead Points of a Galvanometer Needle for Transient Currents : A. Russell.—Exhibition of Lippmann Capillary Dynamo and Electromotor : Prof. H. A. Wilson.—Exhibition of an Apparatus for demonstrating the Movements of the Diaphragms of Telephonic Transmitters and Receivers and the Current flowing into and out of the Cable during Speech : W. Duddell.

ROYAL ASTRONOMICAL SOCIETY, at 5.—Observations of *Uranus* at Windsor, New South Wales : John Tebbutt.—Observations of Comet c 1905 : Natal Observatory.—Note on the Parallax and Proper Motion of the Central Star in the Annular Nebula in Lyra : B. L. Newkirk.—On the Ratios of the Triangles in the Determination of the Elliptic Orbit from Three Observations : S. Hirayama.—Some Considerations regarding the Number of the Stars : Miss W. Gibson.—On the Ancient Eclipses of the Sun : E. Nevill.—Elements of Five Long-Period Variable Stars : A. Stanley Williams.—On the Orbit and Mass of 85 Pegasi : W. Bowyer and H. Furner.—Some Points arising out of a Discussion of the Double Stars in Struve's Mensurae Micrometricæ : T. Lewis.—Exhibition of Stereoscopic Star Charts North of 20° N. Decl., and South, if near the Milky Way : T. E. Heath.

MALACOLOGICAL SOCIETY, at 8.—Notes on the Subgenus *Malluvium* : E. A. Smith, I.S.O.—Notes on some Species of the Genus *Mitra*, with the Description of *M. Brettinghami*, n.sp. : E. A. Smith, I.S.O.—On some Land- and Fresh-water Mollusca from Sumatra, part ii. : Rev. R. Ashington Bullen.—Notes on a Collection of Nudibranchs from the Cape Verde Islands : C. Crossland and Sir Charles Eliot, K.C.M.G.—Notes on Indian and Ceylonese Species of *Glossula* : Col. R. H. Beddome.

TUESDAY, MAY 15.

ROYAL INSTITUTION, at 5.—Glands and their Products : Prof. William Stirling.

UNIVERSITY OF LONDON, at 5.—The Atmospheric Circulation and its Relation to Weather : Dr. W. N. Shaw, F.R.S.

ZOOLOGICAL SOCIETY, at 8.30.

FARADAY SOCIETY, at 8.—The Electrolysis of Fused Zinc Chloride in Cells Heated Externally : Julius L. F. Vogel.—Sensitiveness of the Platinum Electrode : H. D. Law.

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WEDNESDAY, MAY 16.

SOCIETY OF ARTS, at 8.—The Development of Watermarking in Hand-made and Machine-made Paper : Clayton Beadle.

ROYAL MICROSCOPICAL SOCIETY, at 8.—Exhibition of Pond Life.

ROYAL METEOROLOGICAL SOCIETY, at 4.30.—An Instrument for Testing and Adjusting the Campbell-Stokes Sunshine Recorder : Dr. W. N. Shaw, F.R.S., and G. C. Simpson.—The Development and Progress of the Thunder Squall of February 8, 1905 : R. G. K. Lempert.

THURSDAY, MAY 17.

ROYAL SOCIETY, at 4.30.—*Probable Papers* : Determinations of Wave-length from Spectra obtained at the Total Solar Eclipses of 1900, 1901 and 1905 : Prof. F. W. Dyson, F.R.S.—Some Stars with Peculiar Spectra : Sir Norman Lockyer, K.C.B., F.R.S., and F. E. Baxandall.—An Apparent Periodicity in the Yield of Wheat for Eastern England, 1885–1905 : Dr. W. N. Shaw, F.R.S.—Some Physical Constants of Ammonia, a Study of the Effect of Change of Temperature and Pressure on an Easily Condensable Gas : Dr. E. P. Perman and J. H. Davies.

CHEMICAL SOCIETY, at 8.30.—The Relation between Absorption Spectra and Chemical Constitution, part vi., The Phenyl Hydrazones of Simple Aldehydes and Ketones : E. C. C. Baly and W. B. Tuck.—Aromatic Compounds obtained from the Hydroaromatic Series, part ii., The Action of Phosphorus Pentachloride on Trimethylidihydroresorcin : A. W. Crossley and J. S. Hills.—Studies of Dynamic Isomerism, part v., Isomeric Sulphonic-derivatives of Camphor : T. M. Lowry and E. H. Magson.—Studies on Basic Carbonates, part i., Magnesium Carbonates : W. A. Davis.

ROYAL INSTITUTION, at 5.—The Influence of Ptolemaic Egypt on Graeco-Roman Civilisation : Rev. J. P. Mahaffy.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Notes on Overhead Equipment of Tramways : R. N. Tweedy and H. Dudgeon.

FRIDAY, May 18.

ROYAL INSTITUTION, at 9.—International Science : Prof. A. Schuster F.R.S.

SATURDAY, MAY 19.

ROYAL INSTITUTION, at 3.—The Old and New Chemistry : Sir James Dewar, F.R.S.

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